WHAT IS CLAIMED IS:

1. A method for processing a substrate comprising the steps of:

a. forming a high surface area to volume ratio material layer over a surface of said substrate; and

b. removing at least a portion of said high surface area to volume ratio material layer.

2. The method of claim 1, wherein said high surface area to volume ratio material layer is deposited over said substrate in step (a), wherein said high surface area to volume ratio material layer has a ratio of up to 10,000 to 1. 112 2nd

3. The method of claim 1, wherein said high surface area to volume ratio material layer is a columnar void layer deposited metal, dielectric, semiconductor . 112

4. The method of claim 3, wherein said columnar void layer comprises a plurality of uniform essentially non-contacting basic columnar-like units penetrating a continuous void wherein said units have adjustable regular spacing, adjustable uniform height, and adjustable variable diameter, and said plurality of basic columnar-like units are uniformly orientated and disposed over said substrate.

5. The method of claim 4, wherein said basic columnar-like units comprise at least one component selected from the group consisting of: silicon, germanium, carbon, hydrogen, inorganics, organics, and mixture thereof.

6. The method of claim 3, wherein said columnar void layer has a thickness of at least 10 nm.

7. The method of claim 3, wherein said columnar void layer is deposited in a vacuum environment of pressure less than atmospheric pressure.

8. The method of claim 3, wherein said columnar void layer is deposited at a temperature of less than about 250°C.

9. The method of claim 1, wherein said high surface area to volume ratio material layer is formed upon at least one intervening layer located between said high surface area to volume ratio material layer and said substrate.

10. The method of claim 1, wherein said removal of said high surface area to volume ratio material layer in step (b) is conducted by chemical means, physical means or a combination thereof.

11. The method of claim 1, wherein said removal of said high surface area to volume ratio material layer in step (b) is by means selected from the group consisting of: dry etching, wet etching, and a combination thereof.

12. The method of claim 1, wherein a portion of said substrate is also removed before, while or after removing at least a portion of said high surface area to volume ratio material layer in step (b).

13. The method of claim 9, wherein a portion of said intervening layer or layers between said high surface area to volume ratio material layer and said substrate is also removed.

14. The method of claim 1, further comprising the step of depositing at least one coating over said high surface area to volume ratio material layer after forming said high surface area to volume ratio material layer over a surface of said substrate in step (a).

15. The method of claim 14, wherein said at least one coating is organic or inorganic.

16. The method of claim 14, further comprising the step of fabricating a device, structure, or combination thereof over said at least one component selected from the group consisting of: device, coating structure, coating, and mixtures thereof.

Delaminate

17. The method of claim 16, wherein said removing of at least a portion of said high surface area to volume ratio material layer in step (b) disengages at least one component selected from the group consisting of: device, coating structure, coating, and mixtures thereof from said substrate.

18. The method of claim 16, further comprising the step of creating through-holes through at least one component selected from the group consisting of: device, coating structure, coating, and mixtures thereof, to remove said high surface area to volume ratio material layer.

19. The method of claim 16, further comprising the step of creating through-holes through said substrate to remove said high surface area to volume ratio material layer.

20. The method of claim 16, further comprising the step of creating through-holes through said at least a coating to remove said high surface area to volume ratio material layer.

21. The method of claim 16, further comprising the step of forming a second coating ~~over~~ up at least one component selected from the group consisting of: device, coating structure, coating, and mixtures thereof.

22. The method of claim 17 and claim 21, wherein said second coating system acts as a carrying substrate thereby allowing transporting of the combination comprised of devices and structures, after removal of said high surface area to volume ratio material layer of step (b).

No Antecedence

23. The method of claim 22 , after removal of said high surface area to volume ratio material layer in step (b) through said created through-holes, separating the at least one component selected from the group consisting of: device, coating structure, coating, and mixtures thereof from said substrate, thereafter further comprising the step of disposing said separated device, coating structure, coating, or mixtures thereof over a second substrate.

laminating

24. The method of claim 1, wherein the step of removing a portion of said high surface area to volume ratio material layer in step (b) comprises a step of selectively etching said high surface area to volume ratio material layer, such that a portion thereof is retained.

25. The method of claim 24, further comprising the step of forming at least one layer over said retained portion of said high surface area to volume ratio material layer.

26. The method of claim 25, further comprising the steps of

(a) creating through-holes to access said high surface area to volume ratio material layer; and

(b) removing said retained portion of said high surface to volume ratio material layer using said through-holes to produce a cavity structure no period

27. The method of claim 26, further comprising the step of removing said retained portion of said high surface area to volume ratio material layer using said through-holes to produce a cavity structure, followed by a step of depositing at least one further layer over said at least one layer, thereby blocking said through-holes.

28. The method of claim 1, wherein the step of providing a substrate comprises the step of: depositing a stencil layer on said substrate; patterning said stencil layer and selectively removing a portion of said stencil layer, thereby leaving an exposed portion of said substrate and at least one retained portion of said stencil layer.

29. The method of claim 28, wherein the step of forming a high surface area to volume ratio material layer comprises forming said high surface area to volume ratio material layer upon said exposed surface of said substrate and on said at least one retained portion of said stencil layer, further comprising the step of lifting off

said stencil layer, thereby also removing a portion of said high surface area to volume ratio material layer deposited thereon.

30. The method of claim 29, further comprising the step of: (c) depositing a second layer over said substrate and said high surface area to volume ratio material layer.

31. The method of claim 30, further comprising the step of creating through-holes through said second layer for the removal of said high surface to volume ratio material layer in step (c) through said created through-holes to produce a cavity structure.

32. The method of claim 31, after removal of said high surface area to volume ratio material layer in step (c) through said created through-holes to produce a cavity structure, thereafter further comprising the step of: (d) depositing a layer that blocks said through-holes.

33. The method of claim 31, after removal of said columnar void layer in step (c) through said created through-holes to produce a cavity structure, thereafter further comprising the steps of: adding a gas or liquid in said cavity structure; and depositing a layer that blocks said through-holes and seals said cavity structure.

34. The method of claim 1, wherein prior to step (a), a material system is deposited on said substrate followed by selectively removing portions of said deposited material system retaining a portion of said material system.

35. The method of claim 34, wherein the step of forming said high surface area to volume ratio material layer over said substrate further comprises the step of removing a portion of said high surface area to volume ratio material layer to expose a portion of said retained material.

36. The method of claim 35, further comprising the step of depositing additional material over said high surface area to volume ratio material layer and exposed portions of said previously deposited material, so that a portion said additional material contacts an exposed portion of said previously deposited material.

37. A method of transferring a system of materials from a substrate comprising:

a. forming a high surface area to volume ratio material layer onto a substrate;

b. forming at least one coating over said high surface area to volume ratio material layer;

c. fabricating at least one component selected from the group consisting of: device, coating structure, coating, and mixtures thereof over said at least one coating; and

d. removing said high surface area to volume ratio material layer, thereby separating said at least one component selected from the group consisting of: device, coating structure, coating, and mixtures thereof from said substrate.

38. The method of claim 37, wherein said high surface area to volume ratio material layer is a columnar void layer.

39. The method of claim 38, wherein said columnar void layer is deposited.

40. The method of claim 38, wherein said columnar void layer is a nano-scale composition comprising:

(a) a plurality of uniform essentially non-contacting basic columnar-like units penetrating a continuous void wherein said units have adjustable regular spacing, adjustable uniform height, and adjustable variable diameter, and

(b) said plurality of basic columnar-like units are uniformly orientated and disposed on said substrate.

41. The method of claim 37, wherein said first substrate is rigid.

42. The method of claim 37, wherein said first substrate is at least one selected from the group consisting of: silicon wafers, quartz, glass, organic materials, polymers, ceramics, semiconductors, metals, insulator materials, and mixtures thereof.

43. The method of claim 37, wherein forming at least one coating over said high surface area to volume ratio material layer in step (b) is performed by a technique selected from the group consisting of: applying, spin-coating, screening, printing, sputtering, evaporating, chemically depositing, physically depositing, and spreading.

44. The method of claim 37, wherein said at least one coating is organic , inorganic, or some combination thereof.

45. The method of claim 37, wherein said at least one coating is a material selected from the group consisting of: chemically active materials, polymers, insulators, nitrides , oxides, piezoelectrics, ferroelectrics, metals, pyroelectrics, biological materials , and semiconductors.

46. The method of claim 37, wherein said at least one component selected from the group consisting of: device, coating structure, coating, and mixtures thereof is selected from the group consisting of: sensors, actuators, electronics, chemical micro-fluidics, detectors, immobilizing structures, circuits, displays, acoustic devices, solar cells, opto-electronic devices, fuel cells and combinations thereof.

47. The method of claim 37, further comprising a step of creating through-holes used to remove said high surface area to volume ratio material layer.

48. The method of claim 47, wherein said through-holes are created through at least a layer selected from the group consisting of: said substrate, said high surface area to volume ratio material layer, an intervening layer between said substrate and said high surface area to volume ratio material layer, a coating layer on said high surface to volume ratio material, and a combination thereof.

49. The method of claim 47, whereby creating through-holes is performed using a technique selected from a group consisting of dissolving, dry etching and wet etching.

50. The method of claim 37, wherein removing said high surface area to volume ratio material layer in step (d) is performed by chemical means, thermal means, mechanical means or a combination thereof.

51. The method of claim 37, further comprising the step of disposing said at least one component selected from the group consisting of: device, coating structure, coating, and mixtures thereof onto a second substrate.

52. The method of claim 51, further comprising the step of depositing at least one coating over said at least one component selected from the group consisting of: device, coating structure, coating, and mixtures thereof.

53. The method of claim 52, where said at least one coating over said at least one component selected from the group consisting of: device, coating structure, coating, and mixtures thereof is disposed over a second substrate after separating said at least one component selected from the group consisting of: device, coating structure, coating, and mixtures thereof from said substrate in step (d).

54. The method of claim 51, wherein said second substrate is flexible, curved, irregularly shaped, or all of these.

55. The method of claim 54, wherein said second substrate is an organic material.

56. The method of claim 51, wherein said at least one component selected from the group consisting of: device, coating structure, coating, and mixtures thereof disposed over said second substrate is for the fabrication of a thin film system which is selected from the group consisting of: transistors, diodes, displays, sensors, actuators, detectors, acoustic devices or arrays, microelectro-mechanical devices, fuel cells, biological systems or arrays, and solar cells.

57. A method for creating a cavity structure comprising:

a. forming a high surface area to volume ratio material layer over a substrate;

b. forming at least one layer over said high surface area to volume ratio material layer; and

c. removing a portion of said high surface area to volume ratio material layer thereby creating a cavity structure.

58. The method of claim 57, wherein said high surface area to volume ratio material layer is a columnar void layer.

59. The method of claim 58, wherein said columnar void layer is deposited.

60. The method of claim 58, wherein said columnar void layer is a nano-scale composition comprising:

(a) a plurality of uniform essentially non-contacting basic columnar-like units penetrating a continuous void wherein said units have adjustable regular spacing, adjustable uniform height, and adjustable variable diameter, and

(b) said plurality of basic columnar-like units are uniformly orientated and disposed over said substrate.

61. The method of claim 57, wherein said substrate is selected from the group consisting of: silicon wafer, quartz, glass, organic materials, polymers, ceramics, semiconductor, metals, and mixtures thereof.

62. The method of claim 57, whereby said high surface area to volume ratio material layer deposited over said substrate in step (a) is subsequently patterned.

63. The method of claim 57, whereby said high surface area to volume ratio material layer is patterned by using a soft masking material, hard masking material, or a combination thereof.

64. The method of claim 57, wherein removing said portion of said high surface area to volume ratio material layer in step (c) is performed by chemical means, mechanical means or a combination thereof.

65. The method of claim 57, wherein removal of said portion of said high surface area to volume ratio material layer in step (c) also removes a portion of said substrate.

66. The method of claim 57, said at least one layer over said high surface area to volume ratio material layer is a material selected from the group consisting of: chemically active materials, polymers, insulators, nitrides, oxides, piezoelectrics, ferroelectrics, metals, pyroelectrics, biological materials and semiconductors.

67. The method of claim 57, further comprising the step of adding gas or liquid into said cavity structure after said high surface area to volume ratio material layer is removed in step (c).

68. The method of claim 57, further comprising the step of creating through-holes through said at least one layer to access said high surface area to volume ratio material layer.

69. The method of claim 57, further comprising the step of forming an additional layer over said substrate after removing said high surface area to volume ratio material layer of step (c), thereby blocking said through-holes.

70. The method of claim 57, wherein the height of said cavity structure is at least 10 nm no per

71. The method of claim 57, wherein the width of said cavity structure is at least about 10nm.

72. The method of claim 57, wherein creation of said cavity structure provides for the fabrication of a use selected from the group consisting of: MEMS; field emission sources; bolometric structures; accelerometers; light trapping; resonance; field shaping; transmission; acoustic trapping; display micro-mirror formations; biomedical and medical devices; sorting structures for functions such as DNA and proteomic sorting; cellnutrition, growth control, or both; capillary functions ; gettering regions for solid phase crystallization or silicon on insulator structures; interlayer stress control; optical waveguide and optical device applications; fluid channels for electrical, chemical ,and electro-chemical sensors,

chromatography, chemical reactant/ product transport; fuel cells ;displays; and molecular sorting.

73. The method of creating a cavity structure in a substrate comprising:

a. forming at least one stencil layer over a substrate;

b. removing a portion of said stencil layer thereby created an exposed portion of said substrate;

c. forming a high surface area to volume ratio material layer over said portion of said stencil layer and said exposed substrate;

d. lifting off a portion of said stencil layer, thereby also removing a portion of said high surface area to volume ratio material layer formed thereover and leaving the portion of said high surface area to volume ratio material layer formed on said exposed substrate;

e. forming at least one layer over said substrate and said high surface area to volume ratio material layer; and

f. removing said high surface area to volume ratio material layer to form a cavity structure.

74. The method of claim 73, wherein said stencil layer comprises a material selected from the group consisting of: photoresists, nitrides, oxides, metals, polymers, dielectrics and mixtures thereof.

75. The method of claim 73, wherein said substrate is selected from the group consisting of: silicon wafer, quartz, glass, organic materials, polymers, ceramics, semiconductor, metals, insulators, and mixtures thereof.

76. The method of claim 73, whereby removing said stencil layer in step (b) is performed using a technique selected from a group consisting of: dissolving, dry etching, wet etching and combinations thereof.

77. The method of claim 73, wherein said high surface area to volume ratio material layer is deposited.

78. The method of claim 73, wherein said high surface area to volume ratio material is a columnar void layer.

79. The method of claim 78, wherein said columnar void layer is a nano-scale composition comprising:

(a) a plurality of uniform essentially non-contacting basic columnar-like units penetrating a continuous void wherein said units have adjustable regular spacing, adjustable uniform height, and adjustable variable diameter, and

(b) said plurality of basic columnar-like units are uniformly orientated and disposed over said substrate.

80. The method of claim 73, wherein lifting off said stencil layer in step (d) is performed by dissolving, etching or a combination thereof.

81. The method of claim 73, wherein said at least one layer is a material selected from the group consisting of: chemically active materials, polymers, insulators, nitrides, oxides, piezoelectrics, ferroelectrics, metals, pyroelectrics, biological materials and semiconductors.

82. The method of claim 73, wherein removing the high surface area to volume ratio material layer in step (f) is performed by chemical means, mechanical means or a combination thereof.

83. The method of claim 73, further comprising the step of creating through-holes to access said high surface area to volume ratio material layer.

84. The method of claim 73, further comprising the step of adding gas or liquid into said cavity structure after said high surface area to volume ratio material layer is removed in step (f).

85. The method of claim 83, further comprising the step of depositing a further layer, wherein said further layer blocks said through-holes.

86. The method of claim 85, wherein said further layer is a material selected from the group consisting of: dielectric, polymeric, metal, photoresist, nitride, oxide, biological , semiconductor, and insulator materials and mixtures thereof.

87. The method of claim 73, wherein said cavity structure has a height of at least 10 nm.

88. The method of claim 73, wherein said cavity structure has a width of at least 10 nm.

89. The method of claim 73, wherein formation of said cavity structure provides for the fabrication of a use selected from the group consisting of: MEMS; field emission sources; bolometric structures; accelerometers; light trapping; resonance; field shaping; transmission; acoustic trapping; display micro-mirror formations; biomedical and medical devices; sorting structures for functions such as DNA and proteomic sorting; cell nutrition, growth control, or both; capillary functions; gettering regions for solid phase crystallization or silicon on insulator structures; interlayer stress control; optical waveguide and optical device applications; fluid channels for electrical, chemical, and electro-chemical sensors, chromatography, chemical reactant/product transport; fuel cells; display, and molecular sorting.

90. A method of producing at least one contact region between a first and a second material system over a substrate comprising the steps of:

a. forming a first material system over said substrate;

b. etching a portion of said first material system;

c. forming high surface area to volume ratio material layer over said first material system and said substrate;

d. removing a portion of said high surface area to volume ratio material layer to expose a portion of said first material system;

e. forming a second material system over said high surface area to volume ratio material layer and exposed portions of said first material system, so that a portion of said second material system contacts a portion of said first material system; and

f. removing said high surface area to volume ratio material layer, thereby freeing a portion between said first and second material systems while maintaining said at least one contact region.

91. The method of claim 90, wherein said first material system is selected from the group consisting of: metals, semiconductors, chemically active materials, polymers, insulators, nitrides, oxides, piezoelectrics, ferroelectrics, pyroelectrics, biological materials, organic materials and combinations thereof.

92. The method of claim 90, wherein said substrate is a material selected from the group consisting of: silicon wafer, quartz, glass, organic materials, polymers, ceramics, semiconductor, metals, and mixtures thereof.

93. The method of claim 90, wherein said second material system is selected from the group consisting of: metals, semiconductors, chemically active materials, polymers, insulators, nitrides, oxides, piezoelectrics, ferroelectrics, pyroelectrics, biological materials, organic materials, and combinations thereof.

94. The method of claim 90, wherein removal of said high surface area to volume ratio material layer is facilitated by chemical means, physical means or combination thereof.

95. The method of claim 94, wherein removal of said high surface area to volume ratio material layer by chemical means has an etch rate of 25 μm per minute or less.

96. The method of claim 90, wherein production of at least one contact region between a first and a second material system provides for fabrication of a structure selected from the group consisting of: MEMS devices, cantilever structures, micro-switch structures, micro-mirror structure, actuators, field emission structures, bolometric structures, accelerometers, biomedical and medical devices, sorting and affixing structures, and electrical, chemical, and electro-chemical sensors.

97. A method for fabricating a chemical transport/chemical catalysis assembly including the step of forming channels within or over a substrate for bearing reactants, products, or both, said channels and said catalysis structures being formed by claim 1.

98. A method for fabricating a fuel cell comprising:

a. depositing a masking layer on a substrate;

b. defining the locations of the channel regions in said masking layer using a stencil layer;

c. covering said defined regions in said masking layer and said stencil layer in adjoining regions with a sacrificial layer material;

d. lifting off said sacrificial layer material in the stencil covered regions by dissolving or etching away said stencil layer;

e. depositing an anode material over the entire resulting surface for the layer formed in step (d);

f. patterning said anode material to form an anode;

g. depositing an electrolyte on the resulting surface for the layer formed in step (d);

h. employing means to access said sacrificial layer;

i. using such means to etch or dissolve the sacrificial layer in the regions that are to be the channels;

j. using these regions of removed sacrificial material as defining regions for subsequent or continued etching or dissolving of underlying material to create said channels bearing fuel, oxidant, or both;

k. depositing and patterning a cathode material on the resulting surface for the layer formed in step (d); and

l. depositing and patterning interconnects and contacts on the resulting surface for the layer formed in step (d), thereby providing electrical current flow and power production for said fuel cell.

99. The method of claim 1 wherein said high surface area to volume ratio material performs an affixing, sorting, immobilizing, or combination thereof function.